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(54) Run-flat tyre and wheel assemblies

(57) A pneumatic tyre and rim assembly comprises a radial belted tyre (2) mounted on a flat- or well-base rim (10), a pneumatic emergency support means (20) for bearing the load when the tyre is punctured, and a lubricant layer (18) for reducing friction between the tyre and support means when running deflated. The support means (20) has a support surface element (22) made of fabric, e.g. aromatic polyamide cord fabric, which is reinforced by a layer (23) of plastics material or synthetic resin, e.g. polyurethane, polyester or epoxy resin. The layer (18) comprises a gel formed predominantly of polyglycol and having roller body particles, e.g. of rubber powder and/or glass or plastics beads, contained therein. The layer (18) is arranged on the inside surface (9) of the tyre to cover at least that part of the surface (9) in the tread region.

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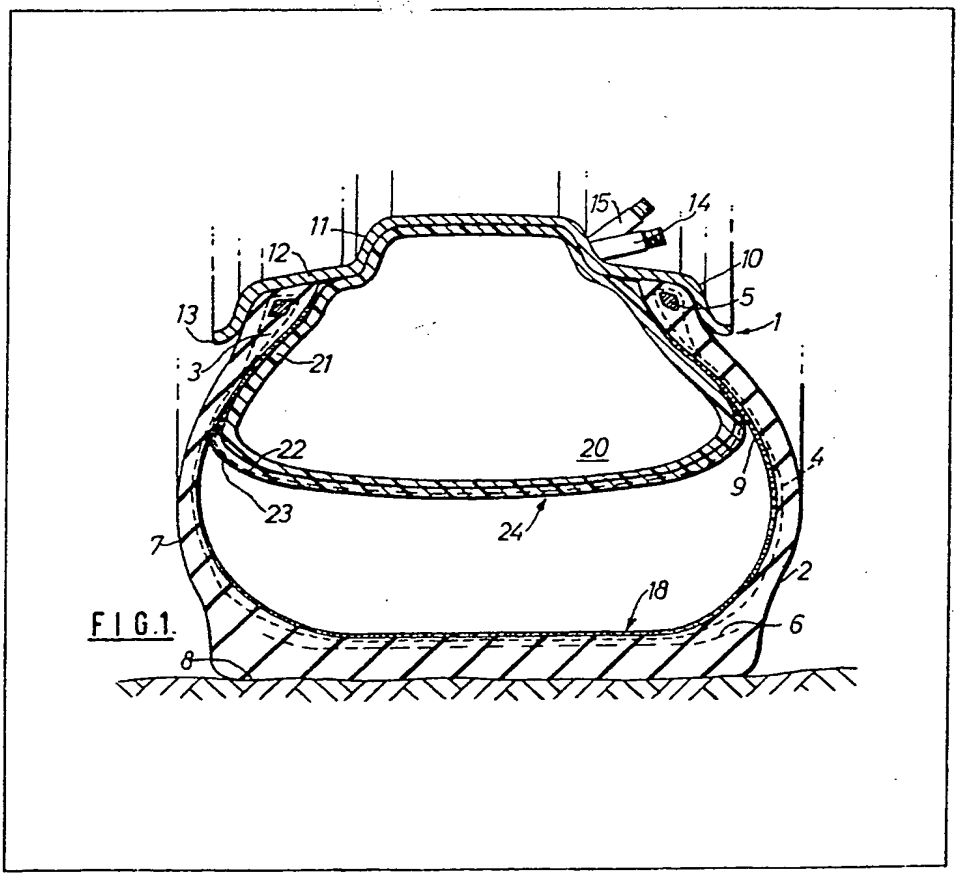

FIG.1.

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

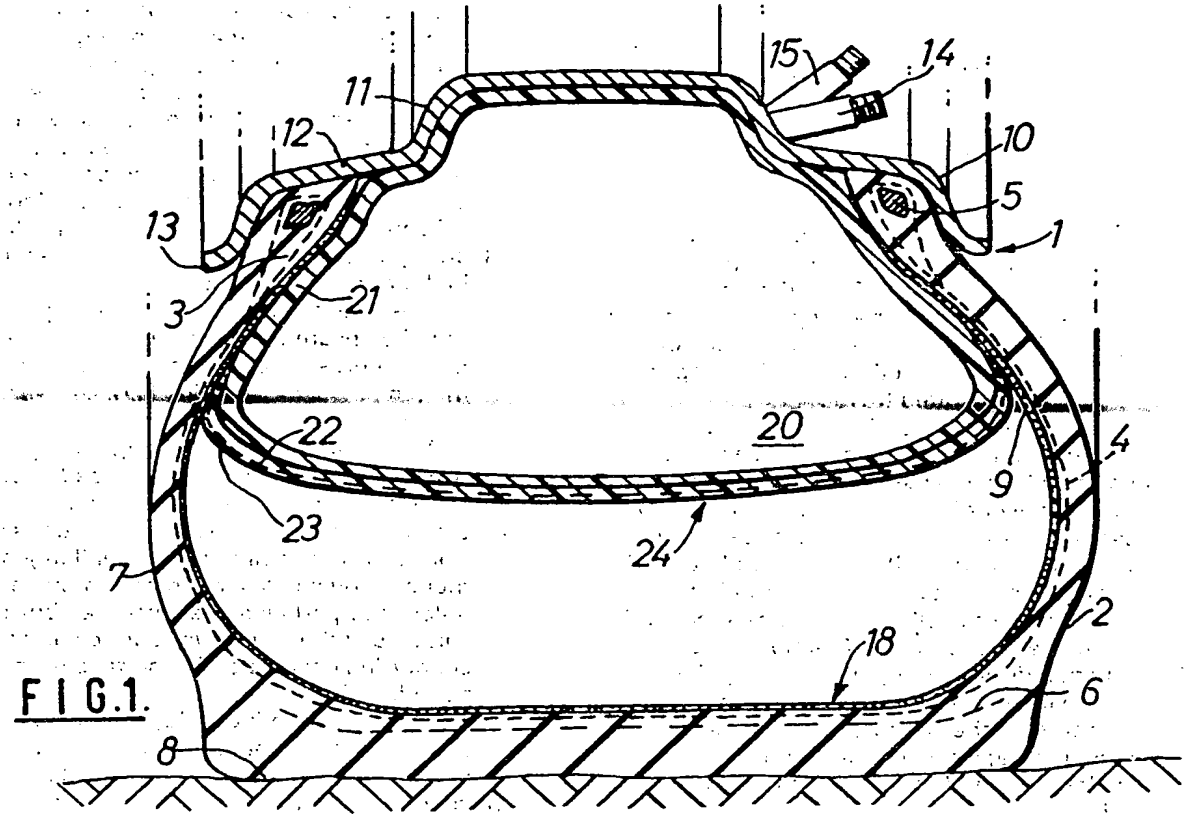

FIG.1.

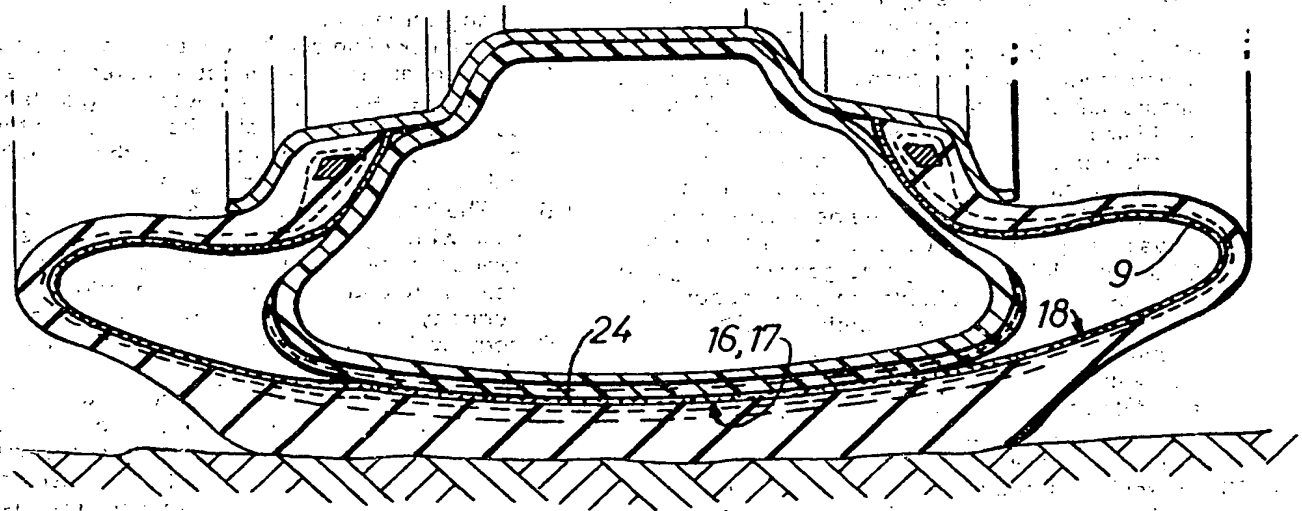

FIG.2.

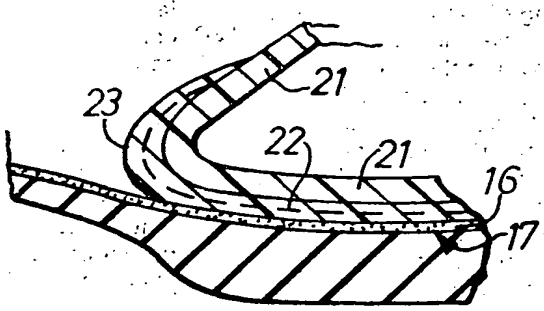

FIG.3.

SPECIFICATION
Emergency wheel

The present invention relates to a pneumatic tyre and rim assembly having a supporting device for bearing the load when the tyre is punctured.

Such assemblies, for example, are known from FR—PS 1514964 and the DE—OS 2600691. In these assemblies, the supporting device comprises a tube-like, inflatable hollow body which, when a puncture occurs, supports the beads against slipping off the rim and bears the load resting thereon. The support surface of such support device has a layer containing lubricants through which the friction with the supported load is reduced for limited travel.

These known assemblies are unfavourable with reference to the supporting surface reinforcement and the lubricants used. The means for reinforcing are relatively rigid and very heavy. This also makes assembly difficult. The lubricants used, with regard to their viscosity stability and durability, are unsatisfactory. After a certain period of running under normal travelling conditions such lubricants are unable to ensure any functional friction reduction during emergency running. Moreover, the application of the layer containing the lubricants on the supporting device is unfavourable; it additionally complicates the development and handling of the supporting device.

Emergency running devices, however, on the one hand should be as light as possible and, on the other hand, made as stable as possible, without impairing the lightweight method of construction. With a sudden loss of air they should ensure sufficient steering ability of the vehicle to avoid accidents. Furthermore, they should function, possibly without problems, so as to travel a sufficient distance with a defective tyre at a reasonable speed. Thus, the heat developed plays an important part due to the unfavourable friction conditions during emergency running and requires control by suitable means. Last but not least this is decided by the method and application of suitable means for reducing friction. Of considerable importance, of course, is also attributed to the method of the support surface reinforcement used.

It is therefore an object of the present invention to provide a pneumatic tyre-rim assembly of the kind described above in which the emergency running support surface is made specifically lightweight and is highly resistant to defects and in which means for reducing friction are provided, which are and remain viscosity-stable and durably functionable and provide favourable rolling conditions at the emergency running surface.

According to the present invention there is provided a pneumatic tyre and rim assembly comprising a pneumatic tyre having a radial carcase and a belt-like tread surface reinforcement, and a rim having a flat-base or drop-base, a supporting device bearing the load when the tyre is punctured being located in the bed of the rim and a friction reducing layer being provided between the inside tyre surface and the support surface of the supporting device, in which the supporting device comprises an annular hollow body having a support surface element made of fabric which is reinforced by a layer of plastics material or synthetic resin, and in which the friction reducing layer comprises a gel formed predominantly of polyglycol and having roller body particles contained therein and which layer is arranged on the inside surface of the tyre at least in the tread surface region.

The bearing capacity during tyre puncture is thereby ensured with adequate speed, because the support surface reinforcement and the support friction conditions provided are substantially improved.

The emergency running supporting device, which is provided with a reinforced supporting surface, reliably catches the collapsing defective tyre and prevents the sidewall sections of the tyre from abutting against the wheel flanges. The friction reducing layer, which is provided with mini roller body particles, prevents the abutting surfaces of the inside wall surface and the supporting device bearing surface from being frayed.

This friction reducing layer thereby prevents any inadmissible heat development at the points of contact concerned. Extensive rolling friction conditions provided during emergency running permits an easy continued travel and detachment of the tyre from the rim is also avoided thereby during cornering.

The risk of an accident of the vehicle is hence substantially reduced, if not rendered impossible. Even an emergency travel over a long distance at a speed, say as permissible when travelling through a built-up area, does not exclude the defective tyre being used again after being mended.

The improvement of the emergency means used with regard to the bearing surface element resides in that it is sufficiently flexible, whilst still being hard and lightweight. Installation is effected during tyre assembly together with the hollow body, which form a unitary structure, in a relatively simple manner and in a short time.

The improvement with reference to the friction reducing means resides in that the gel may be applied without problems before tyre assembly to the inside surface of the tyre. It is insensitive to heat generated during tyre use, because it is viscosity stable and able to perform its function even after a long idle period. The gel also has a favourable hygroscopic property; thus, it absorbs a considerable proportion of dampness from the air contained in the tyre and bonds it. Dampness is always the cause of rust forming on metal reinforcing members in tyres, and this has to be prevented.

The means permitting the actual rolling friction are present in the shape of small particles embedded in the gel; they may be comprised of rubber powder and/or plastics material and/or glass beads. Their body shape and size and

number permit a favourable rolling movement between the emergency surfaces. They prevent the surfaces normally becoming hot during emergency running from being frayed by abrasion.

Favourable further developments of the invention relate to the composition of the preferred means for reducing friction. The friction reducing layer preferably comprises about 70% by weight of polyglycol and silicon oxide and 30% by weight of rubber powder of varying particle size, coarser particles having a grain size of from 500 μm to about 1250 μm and finer particles having a grain size from 500 μm to 100 μm being provided. The finer particles may also be supplemented or replaced by correspondingly suitable glass beads and/or plastics material beads. It is thus possible to replace the rubber powder of small particle size by glass beads of a particle size of about 100 μm to 150 μm. Moreover, it is also possible for glass beads and plastics material beads having a particle size larger than 150 μm to b eused, either together with the rubber powder particles or with the aforesaid glass beads of smaller particle size.

A further favourable further development relates to the support surface reinforcement. It comprises a non-metal filament material of high specific strength. Preferably used are cord textiles and aromatic polyamides present as belt-like fabric, for example, cross fabrics. The filaments or the fabric are coated at least on one side with a suitable plastics material or synthetic resin. Preferred plastics materials are polyurethane and polyester. Preferred synthetic resin is epoxy resin. They may be applied by painting or spraying on. They may, however, also be permanently secured to the fabric by a suitable adhesive. The plastics material or synthetic resin layer preferably forms the outer surface of the support surface of the reinforcing element. Depending upon the selection of material and thickness of layer, the fabric may be coated on both sides. It is also possible to saturate the fabric with the said materials.

Such a support surface element is specifically lightweight, sufficiently resilient and deformable, whilst also being puncture-proof and of stable shape during emergency running. Seen in cross-section, it is preferably formed as a belt-like ring having dish-like inwardly drawn edges. This ring is then preferably securely connected to a tube-like hollow body. For this reason it is thus convenient to install.

A further use of the friction reducing layer according to the invention is provided when it is used in combination with the multi-chamber support element described according to FR. Application No. 7913835. The afore-described advantages concerning the layer comprising the gel and roller body particles is also contained undiminished herein.

In principle, emergency running wheels should be made like normal standard vehicle wheels and their emergency aids should be simple in design and arrangement, so that these wheels can be used like normal vehicle wheels, but in an emergency to fulfil their ensurance of safety. Especially at risk are commercial road users and racing drivers for whom additional expenditure of an emergency aid should be absolutely necessary. It is also justified for vehicle owners thinking of increased safety. Moreover, it is necessary to mention further vehicles particularly in need of protection for using such devices, namely fire brigades and use in disaster relief and for military and the like deployment; in connection with the latter it is also important that with damage due to firing at the tyres, they have to remain functional.

The present invention will be further illustrated, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a radial part section through a pneumatic tyre and rim assembly having an emergency running hollow body located in the bed of the rim and a friction reducing layer applied to the inside surface of the tyre wall;

Fig. 2 shows the arrangement according to Fig. 1 in the emergency running position; and

Fig. 3 shows a detail in section of the support surfaces present according to Fig. 2.

As illustrated in Fig. 1, the pneumatic tyre and rim assembly 1 comprises a standard tubeless pneumatic tyre 2 and a standard safety drop-base rim 10. It is provided with an emergency running support device 20 and a friction reducing layer 18.

The pneumatic tyre 2 comprises a radial carcase 4, beads 3 with bead rings 5, tyre side walls 7, a belt-like tread surface reinforcement 6 and tread strips having a tread surface 8. The inside surface of the pneumatic tyre is designated by reference numeral 9.

The rim 10 includes a drop-base 11, tyre rim seating surfaces 12, which on one side are provided with a safety bead (hump), and wheel flanges 13. The pneumatic tyre valve is denoted by 14. The further shown valve 15 is for the emergency support device 20.

The device 20 comprises a tube-like hollow body, which is formed substantially of a rubber casing 21 and which in the inflated operational state is pressed against the inside surface of the tyre beads and the drop-base. The external diameter extends somewhat higher than half the sectional height of the tyre.

The support surface element of the emergency support device 20 comprises a fabric belt or strip 22, for example, of polyester or polyamide cross cord fabric, which is securely bonded with a synthetic resin, for example, epoxy resin, in strip or shell form 23. The synthetic resin may also be replaced by a plastics material or comparable properties. Such support surface elements are lightweight, relatively well deformable; on the other hand, however, they are inherently stable and rigid enough to absorb the load in the event of a punctured tyre. Securely connected with this support el ment is a rubber envelope 21. During tyre assembly, they are inserted as a unitary structure 21—23 and filled with compressed air.

The normal operational state of the pneumatic tyre rim assembly is shown in Fig. 1. Fig. 2 shows

the operational state of the punctured tyre. whereby a substantial proportion of the inside tyre surface 9 abuts against the support or bearing surface 24 of the emergency running support device 20.

The friction reducing layer 18 now comes into effect. It comprises a viscosity stable gel based on polyglycol and silicon oxide, which is applied before assembly of the tyre, for example, by being spread or painted on the inside tyre surface. Pseudo-dissolved it forms a relatively tough, spreadable paste-like composition 16. It is non-drip and remains permanently visco-stable. Moreover, it is hygroscopic and absorbs a proportion of the moisture of the compressed air. Mixed into this gel there are numerous roller body particles 17 which are partly comprised of rubber powder and partly of glass and plastics material beads. Preferred rubber powder has a particle size of 0.2 to 1.25 mm. Preferred beads have a particle size of 0.1 to 0.15 mm.

The friction reducing means, on account of the gel and the rolling particles, is applied to the tyre surface as a layer 18; depending upon the size of tyre the volume is 300 to 500 g, and is highly effective during emergency running after a puncture.

Simulated emergency running drives, in which the pneumatic tyre was driven without pressure and only the described emergency running means came into effect, were carried out at speeds of 60, 66 and 70 km/h over distances longer than 50 km, including cornering. Both the pneumatic tyre and the emergency running support devices remained undamaged. Steering conditions during these extraordinary conditions were very satisfactory.

The said measures permit the predetermined object to be obtained that a vehicle can be driven further at high speed with a punctured tyre. The assembly prevented the beads from slipping off the rim thereby causing the tyre to be no longer functional. Especially, however, heat development at the abrading surfaces is kept very low due to the included roller bodies and abrasion-frayed areas are prevented from occurring at the emergency running device or on the tyre.

CLAIMS

1. A pneumatic tyre and rim assembly comprising a pneumatic tyre having a radial carcase and a belt-like tread surface reinforcement, and a rim having a flat-base or drop-base, a supporting device bearing the load when the tyre is punctured being located in the bed of the rim and a friction reducing layer being provided between the inside tyre surface and th support surface of the supporting device, in which the supporting device comprises an annular hollow body having a support surface element made of fabric which is reinforced by a layer of plastics material or synthetic resin, and in which the friction reducing layer comprises a gel formed predominantly of polyglycol and having roller body particles contained therein and which layer is arranged on the inside surface of the tyre at least in the tread surface region.

2. A pneumatic tyre and rim assembly as claimed in claim 1, in which the friction reducing layer is formed of a gel comprises of polyglycol and silicon oxide and small roller body particles of rubber powder and/or plastics material and/or small glass beads.

3. A pneumatic tyre and rim assembly as claimed in claim 1 or 2, in which the friction reducing layer is formed of about 70% by weight of polyglycol and silicon oxide and approximately 30% by weight of rubber powder partly having a particle size from 50 μm to 1250 μm and partly having a particle size from 500 μm to 100 μm.

4. A pneumatic tyre and rim assembly as claimed in claim 3 in which the rubber powder of smaller particle size of from 10 to 25% by weight is replaced by glass beads having a particle size of from 100 to 150 μm.

5. A pneumatic tyre and rim assembly as claimed in any preceding claim, in which glass and/or plastics material beads are provided having a particle size of from 150 μm to 600 μm.

6. A pneumatic tyre and rim assembly as claimed in any preceding claim in which the fabric of the support surface element comprises a non-metallic filament material of high specific strength.

7. A pneumatic tyre and rim assembly as claimed in claim 6, in which the filament material is cord textile.

8. A pneumatic tyre and rim assembly as claimed in claim 6, in which the filament material is an aromatic polyamide.

9. A pneumatic tyre and rim assembly as claimed in any preceding claim, in which the filament material or fabric has an applied, steeped or adhesively applied layer of polyurethane or polyester.

10. A pneumatic tyre and rim assembly as claimed in any preceding claim, in which the layer connected to the fabric comprises an epoxy resin.

11. A pneumatic tyre and rim assembly, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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